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INVESTIGATION OF DIFFERENT VERSIONS OF FORMULATION OF THE PROBLEM OF SOUNDPROOFING OF RECTANGULAR PLATES SURROUNDED WITH ACOUSTIC MEDIA

V. N. Paimushin,[1,2] **D. V. Tarlakovskii,**[3,4] **R. K. Gazizullin,**[1] **and A. Lukashevich**[5]

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We consider five different formulations of the stationary problem of passage of plane acoustic waves through a rectangular plate. The first of these formulations corresponds to the application of the inertial mass model based on the hypothesis of the nondeformability of a nonfixed rigid plate in the course of its interaction with incident and plane acoustic waves formed in the surrounding half spaces. The other four statements correspond to taking into account (according to the model of the Winkler base) or neglecting the compliance of the support contour of a hingedly supported rectangular plate deformed according to the Kirchhoff model and to the application one- or three-dimensional wave equations for the description of motions of the acoustic media and the construction of the equation of motion of the plate with regard for its certain external damping. The use of these last four statements enables us to obtain smoothened graphic frequency dependences whose shapes agree with the experimental dependences obtained by testing specimens in the acoustic laboratory aimed at finding the soundproofing index of the plate.

Introduction

In many cases, the level of admissible vibration of a structure is determined by the level of admissible noise formed in acoustic media surrounding the structure as a result of its dynamic interaction with the deformed structure. The problems of vibration of mechanical systems are mainly studied by experts in the fields of mechanics of deformable solids, dynamics and strength of machines, instruments, and equipment, strength of aircrafts, ships, etc. without giving due attention to the problems of noise caused by the structures in the process of their deformation. At the same time, experts in the field of acoustics deal with the problems of formation and propagation of noise [5, 6, 12].

In the second half of the last century, a new direction of investigations connected with the study of the stationary and nonstationary interaction of acoustic waves with obstacles in the form of deformable bodies and thin-walled structural elements was formed in mechanics. Up to now, the problems of aerohydroelasticity of thin-walled structures in the form of shells that belong to the class of problems studied in this direction have been discussed in numerous works, including a series of monographs and reviews [1–3]. However, in these works, the problems of formation of acoustic waves and the problems of theoretical investigation of soundpoof-

[1] Tupolev Kazan National Research Technical University, Kazan, Russia.

[2] Kazan Federal University, Kazan, Russia.

[3] Research Institute of Mechanics at the Moscow State University, Moscow, Russia.

[4] Moscow Aviation Institute (National Research University), Moscow, Russia.

[5] Białystok Technical University, Białystok, Poland.

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